ARMY GROUND RISK-MANAGEMENT PUBLICATION

COUNTERMEASURE

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POV FATALITIES
THRU DEC FY 99 36
THRU DEC FY 00 18

Rollover accidents leave crewmembers and missions . . .

DEAD in Their Tracks!

PLUS: SPECIAL PULL-OUT POSTERS INSIDE

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COUNTERMEASURE
The Official Safety Magazine for Army Ground Risk-Management

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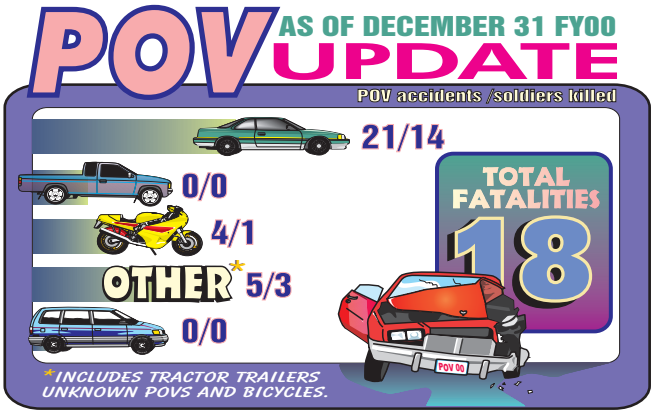

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Bradley Has New Rollover Procedures

A vehicle rollover can be a tragic occurrence resulting in equipment damage, personnel injury, or even death. Until this point, the Bradley Fighting Vehicle Systems did not have a standard Armywide rollover procedure to guard soldiers from being injured or killed. In the past, Bradley master gunners, as well as other leaders, formulated their own set of rollover procedures and trained their units to rehearse and abide by them. This is what we refer to as initiative and proactive thinking in the best interest of our soldiers. There is no question as to whether or not these procedures saved lives, because we all know they did.

The development of Armywide procedures will provide Bradley leaders a set standard by which to train their soldiers. These procedures limit what each soldier is required to do. During recent accident investigations, it was found that soldiers were trying to do too much at the wrong times while the rollover was occurring. Many times, this led to confusion and inconsistencies within units across the Army. Ideally, our intent is to keep the procedures simple—this will save lives and reduce the injuries of our soldiers.

It is also important to maintain and safeguard our equipment. As you review the rollover procedures chart on the opposite page, you will notice that they are in a chronological and prioritized sequence to accommodate an actual vehicle rollover, should one occur. They will also be published in upcoming manual revisions.

BRADLEY ROLLOVER DRILL

The procedures outlined in the chart will assist in training crewmembers in the safe and timely exit from the vehicle.

The senior crewmember will determine if it is safe to exit the overturned vehicle. If practical, soldiers will carry all personal weapons and protective equipment from the vehicle. Proper stowage of equipment will reduce unnecessary injuries caused from flying objects. All equipment should be stowed in accordance with published manuals and unit SOPs.

If a vehicle rolls over, there is a chance that a

fire can start. In the squad area, automatic fire extinguishers are designed to extinguish the fire without the vehicle personnel having to manually set them off. If the automatic system has failed, crewmembers will have to extinguish the fire manually only to the extent that will allow the safe evacuation of the crew.

If there is a fire in the engine compartment, the driver has two options to activate the engine compartment fire extinguisher. He can reach under the driver's control panel and open the valve to the extinguisher or pull the external handle on the left side of the vehicle when out of the vehicle if it is accessible and not damaged.

Editor's Note: For more information, review GPM, TACOM-WRN Control No. GPM-00-005, Implementation of Crew Drill, Bradley Rollover Procedures by contacting your local safety office. ♦

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Risk Management Pointer

Personnel are required to wear seatbelts; equipment is required to be stowed properly and secured; passage from driver's station to crew compartment (Hell hole) will be kept clear. First crew or squad member to notice vehicle beginning to rollover should shout "**ROLLOVER!**"

ROLLOVER PROCEDURES

BC	GUNNER	DRIVER	SQUAD
Drops seat. Braces for impact.	Braces for impact.	Braces for impact.	Braces for impact. Holds hand straps for stability.
BFV HAS ROLLED OVER			
Begins crew checks to ensure no fires; checks accountability of personnel.	Ensures weapon system is on safe and engages travel lock, if possible.	Pulls fuel shut off and turns accessories off. If a fire is present, sets off engine compartment fire suppression system.	Leader checks squad for injuries and reports to Bradley commander.
SENIOR CREWMEMBER DETERMINES IF IT IS SAFE TO EXIT THE VEHICLE AND BEGINS EVACUATION			
Checks for injured personnel; reports incident.	Assists the Bradley commander in evacuating vehicle.	Exits vehicle through driver's hatch or through crew compartment if driver's hatch is blocked.	Exits vehicle through unobstructed hatch. If fire is present, extinguishes fire.
IF SENIOR CREWMEMBER DETERMINES THAT IT IS UNSAFE TO EXIT THE VEHICLE, PERSONNEL WILL WAIT FOR RECOVERY AND ATTEMPT TO CONTACT WINGMAN OR HIGHER.			

WARNING

During a rollover, gas from batteries can explode and cause serious injuries. If the driver must exit through the crew compartment, precaution must be taken to prevent contact with battery acid that could spill and cause serious burns or blindness.

Written by accident investigators to provide major lessons learned from recent centralized accident investigations.

Investigators' Forum

Safety is a Leader Responsibility

A squad-size engineer element was attached to an armor battalion to provide support to their training exercise. The squad received orders to emplace obstacles within the armor battalion's area of operations and began the mission early one morning. After a day of emplacing obstacles, the team prepared to return to their field motor pool site several miles away.

The squad moved in a two-vehicle convoy of M113A3s, with the squad leader in the lead vehicle and the section NCOIC in the trail vehicle. There were four personnel in the lead vehicle with the driver and vehicle commander in their normal positions and two other soldiers sitting in the troop area, holding on to the passenger straps hanging from the top of the vehicle.

As the vehicles continued along the tank trail toward the motor pool at approximately 30-35 miles per hour, the squad leader heard a loud thump from the right rear of the vehicle and he looked inside to check on the two passengers. Immediately following this sound, the vehicle began to fishtail along the tank trail. The vehicle's right-side track had snapped. As the last road wheel left the last block of track, the vehicle began to swerve forcefully toward the left. After spinning nearly 130 degrees to the left, the vehicle left the road and flipped onto its right side. It slid on the right side for approximately 8 feet before coming to rest inverted on the shoulder of the road. The vehicle commander and two passengers in the back were tossed about the vehicle, but did not suffer major injuries. The driver was not so lucky...he was pinned beneath the driver's hatch and suffered fatal injuries.

What Went Wrong?

The accident occurred as the vehicle traveled along a tank trail during normal operations. A track shoe on the right-side track of the vehicle tore apart due to the track pin tearing through the track shoe shore. Inspection of the broken track shoe revealed that the track shoe bushing was worn away, producing metal-on-metal contact. Because of this metal-on-metal contact, a friction-producing movement was applied to the track pin against the track shoe shore, causing the shore to wear down and the track to separate at that location.

The complete separation occurred on the inside portion of the track shore, followed by a fracture failure on the outside portion of the track shore with a noticeable bend in the track pin. In addition, the track shoes on both the right- and left-side track were non-mission capable (NMC) due to worn bushings and bent track pins; thus, the vehicle should have been deadlined. Further, there were three other NMC deficiencies found on this vehicle, but there was no evidence of a pre-mission preventive maintenance checks and services (PMCS) conducted to identify these deficiencies.

The vehicle was also traveling at a high rate of speed. Excess speed increases risk in several ways: it decreases the reaction time of the vehicle crew, increases the momentum of the vehicle, and adds to the stress exerted against the track. When the track separated, the high speed added to the uncontrollable left turn that forced

the vehicle to slide off the tank trail onto a soft shoulder, landing on its top.

Although the vehicle is equipped with restraint devices in both the driver's position and the rear crew compartment, no one was wearing a seatbelt. The use of a seatbelt could have prevented the driver's death. The injuries sustained by the other passengers also could have been avoided with the proper use of seatbelts. Reasons for not wearing the seatbelts varied, but indications were that leaders did not enforce the existing policies for their use.

Lessons Learned

♦ As part of PMCS, the crew should have identified the worn track shoes as well as the other deficiencies. The vehicle operator's manual contains a checklist to identify potentially bad track shoes. It states in DA Pam 738-750 that the commander can "Circle X" a deficiency and impose control measures to allow the unit to continue the mission. However, the commander must first be told of the deficiency and its potential impact on the safe use of the vehicle. For example, restricting the maximum allowable speed of the vehicle or requiring the crew to conduct frequent maintenance halts to check the track could be a couple of control measures that could be used to mitigate the risk posed by the faulty track.

♦ The vehicle's crew failed to observe the speed limit mandated by their division for driving in the training area. The M113 was traveling between 30-35 miles per hour near the point it rolled off the tank trail, however the maximum allowed speed was 25 miles per hour. The vehicle commander did not tell his driver to slow down, nor did the section sergeant who was traveling in the trailing vehicle. A slower speed would have reduced the severity of the turn and possibly allowed the driver to react quicker and ensure he was completely inside the vehicle during the rollover.

♦ The driver failed to wear the required restraint system and was fatally trapped beneath the vehicle. The TC and two passengers were also injured. The passengers in the troop compartment also failed to use the restraint system provided. In fact, the seatbelts in the troop seats were taped in a rolled configuration, indicating they had not been used recently.

Summary

While this accident was caused by a materiel failure, it was preventable. Leader involvement at several points of the accident sequence could have prevented the accident. From the supervision of PMCS procedures to the enforcement of standards (seatbelt usage and speed limits), leader involvement was lacking.

Even more alarming is that this accident is a mirror image of a previous M113A3 accident. The similarities between these two accidents are startling: worn track block, excess speed, and failure to wear restraint devices—all leadership issues. While the facts and circumstances of the first accident were understood in the original unit's chain of command, this critical information had not been disseminated to the unit that suffered the second accident. Hopefully, by getting this critical information to those who use the equipment, these lessons learned will help prevent another such accident. By failing to ensure soldiers know and understand the causes of accidents, leaders may doom their subordinates to repeat the same mistakes that have previously contributed to a soldier's death.

The bottom line is that leaders must enforce standards to keep soldiers safe. Leaders at all levels must apply the risk management principles to identify hazards and then plan for control measures to decrease these hazards. Finally, these leaders must supervise their soldiers as they apply these control measures for all missions. Soldier safety is a leader responsibility...we owe it to our soldiers to do it right!

Scout Training Area...BEFORE It's Too Late

A section of Bradley Fighting Vehicles (BFV) was conducting a tactical movement to a reconnaissance objective in the local training area. The scenario required them to move at night from home station to this location in order to ensure its suitability for an inbound artillery unit. The artillery unit was also traveling from home station, but was using a different route.

There were several bridges near the recon objective. They were not strong enough to carry all of the vehicles using this route, so the unit chose to drive along a streambed instead of risking the collapse of the bridges. The stream was only a few inches deep, so there was no problem using this route.

Since this deployment took place at night, the BFV drivers were using their AN/VVS-2 Driver's Night Viewers, and the Bradley commanders (BCs) used AN/PVS-7 goggles during the tactical phase of the movement. The initial road march,

over civilian roads, was done using white lights and rotating amber warning lights.

As the BFV section entered the stream, the artillery unit approached from the opposite direction. They were still using their headlights and warning lights, which washed out the BFV section's night vision devices. The driver of one of the BFVs asked for permission to pop his hatch so he could see better. His BC approved the request.

To enter the reconnaissance objective, the section had to negotiate a small, steep dirt road out of the streambed. The BFV negotiated the left turn out of the stream and headed up the hill. As they neared the crest, the vehicle began to tip to its right. The crew realized that the Bradley might roll over and therefore took immediate action to attempt to recover. But it was too late. The BFV rolled into a 6-foot deep, water-filled hole, coming to rest on its top. The driver, gunner, and scouts were able to extract themselves from the inverted vehicle, but the BC was trapped. He drowned in the water, which filled the inverted turret almost completely.

What Went Wrong?

The hole beside the path was recently excavated by a civilian earthmover. The training area is not physically secured against civilian intrusion, so a construction crew had brought their scoop loader here to obtain fill dirt for some ongoing project. The hole was immediately adjacent to the path and should have been visible to the BC using night vision goggles. But for unknown reasons, the BC did not notice the hole until the vehicle began to roll over. It was also not visible to the driver due to the steep uphill angle of the vehicle and the use of the popped hatch, which removed his night vision viewer from his immediate view.

Members of this unit were familiar with this training area, and many stated that the hole was not there during their previous visit to this location about three months earlier. Nevertheless, there was no pre-exercise reconnaissance of the training area to identify terrain hazards such as this hole.

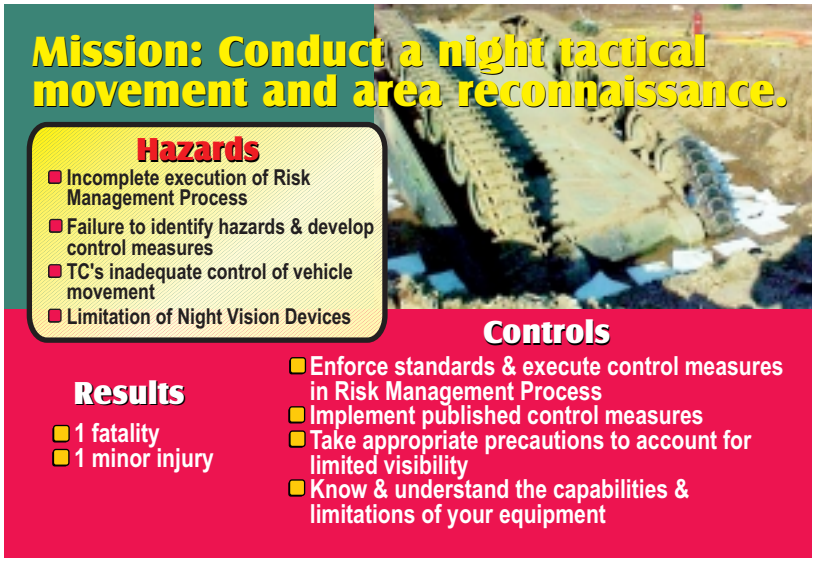
The command's risk management worksheet listed a pre-exercise recon as a control measure to mitigate the possible terrain-related risks associated with this mission. But no element or person was tasked to conduct the recon, and no one followed up to ensure that it was done. This hole was so large and so new to the area that even a cursory daylight reconnaissance should have identified it as a hazard to any vehicle moving along the path out of the stream. As a result of this oversight, the crews did not know this hole was there until they physically encountered it.

Lessons Learned

The fourth and fifth steps in the risk management process are to implement and then supervise and evaluate the control measures developed to reduce the risks. These vital steps were not accomplished. As a result, no recon of the training area took place and the soldiers did not know about the new terrain hazards until it was too late.

Vehicle commanders are responsible for ensuring their vehicles are operated in a safe manner. A key part of this is to observe the terrain around the vehicle to make sure there is nothing in the way, such as a hole or a dismounted soldier. This becomes even more important after the driver admits that he is having trouble seeing through his night vision equipment.

The commander must also be sure that the tank trail is safe, and he must be able to give his driver the proper commands to avoid any hazards in or around that path. If necessary, he should dismount a ground guide.



Summary

Proper risk management at the unit level would have prevented this accident. Proper implementation and supervision of control measures would have most likely identified the hole and after dissemination of this information to the crew, soldiers could have made informed driving choices during their tactical movements. ♦

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Abrams Fires

The lives lost and the resources spent on accidents involving modern Army weapon systems are staggering. Accidents in the Armor Force are no exception. Although Abrams tank fires typically do not result in soldier injuries or fatalities, the potential is always there. A very small fire on these vehicles can quickly cost thousands of dollars in just a couple of minutes.

The fire history of the Abrams fleet provides many concrete lessons learned and examples of how serious maintenance and training pay off. Let's look closely at CY 1999 as an example of how quickly accidents and fires can mount up when we relax.

Calendar year 1999 was not a banner year for Abrams tank fires. Team Abrams continues to investigate all reported fires and pursue possible corrective actions. In the course of investigating reported fires, Team Abrams performed failure analysis on specific hardware, visited units, randomly inspected numerous tanks across the fleet, and reviewed many historical records of tank fires in the fire data base. This effort provided some very definitive facts that Abrams users must be aware of:

♦ Investigations revealed NO systematic materiel cause(s) associated with the recent increase in Abrams fires.

♦ There are several possible contributing factors that are being further investigated and addressed. Fleet aging, high mileage, and lack of preventive maintenance checks and services (PMCS) continue to top the list. These factors are not new and the best corrective action to mitigate these factors is user awareness.

♦ There are random failures and isolated quality issues that have caused a very small number of fires. This category tends to be the exception rather than the norm, and these situations have been corrected.

♦ There are tanks operating in the fleet today that have serious maintenance shortcomings, which could potentially cause a fire. Units MUST adhere to their PMCS inspections and their non-mission capable criteria. This addresses fire sensors; grounding wires; nuclear, biological, and chemical (NBC) system components; reentry test vehicles (RTVs); and unauthorized modifications, just to list a few.

♦ The fire causes are strictly random and have been throughout the life of the Abrams tank. There is not one fire category that stands out as the

ABRAMS TANK FIRES DURING CY95 - CY99
BY "CAUSE OF FIRE"

	1999	1998	1997	1996	1995
HYDRAULIC FIRES	10	8	6	0	3
NBC FILTER FIRES	9	2	1	6	4
FUEL LEAKS	7	4	5	3	2
ELECTRIC	6	5	1	5	5
TRANSMISSION CROSSOVER TUBE	2	0	1	0	0
OTHERS	5	4	2	7	0
TOTAL FOR YEAR	39	23	16	21	14

prominent area of concern; however, NBC system fires still present users with some significant risk and require our serious attention. Besides applying very thorough PMCS, there are no indicators that can alert crews to the fact that they will have a fire. {See Cause of Fire chart.}

♦ The modification block applications currently being applied or previously applied are not directly linked to any fire occurring to date.

With these facts in mind, it is essential that every user:

♦ Assist us in reporting abnormal operations or conditions with their tanks.

♦ Adhere to Safety-of-Use, Ground Precautionary, Maintenance Advisory Messages and Operator and Maintenance manuals.

♦ Rehearse emergency procedures and evacuation procedures regularly.

♦ Take action regarding other prominent safety hazards besides fires; i.e., use of travel locks, hatch condition, bolt accountability, warning light bulb color and condition, and hose sizes and condition.

The Abrams Team is committed to the fact that this tank is the best in the world and it must be totally accepted by you, the users, in every aspect of its operation and sustainment. We will continue to address the trends and inform you of efforts to maximize the tank's capabilities and superiority. ♦

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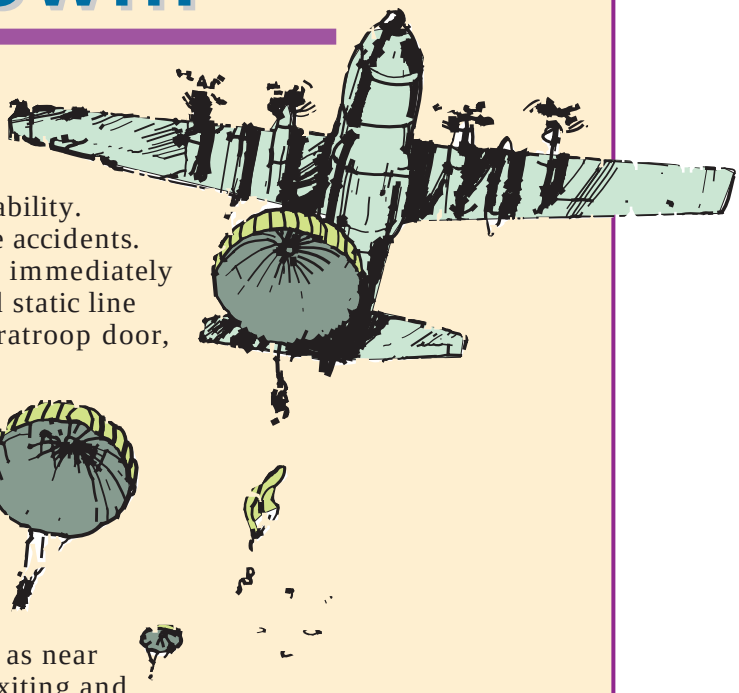
Wrong Way Down!



Within the last 90 days, the U.S. Army Safety Center has investigated three airborne incidents, two of which have resulted in fatalities and one a permanent partial disability. Improper/weak exits contributed to all three of these accidents.

Weak exits induce tumbling, rolling, and spinning immediately outside the paratroop door. This can cause increased static line surface contact (friction) with the trail edge of the paratroop door, which increases the chance of becoming entangled with equipment. Additionally, weak exits adversely affect static line serviceability and attrition rates.

Jumpmasters must ruthlessly enforce standards during performance-oriented training and ensure that all jumpers are briefed concerning the importance of proper exits from any aircraft.

Jumpers exiting a C-130/141 should exit across the center of the jump platform, placing the trail foot as near to the outer edge of the platform as possible before exiting and becoming airborne. They must maintain their momentum after making the pivot to turn towards the door and execute their first point of performance rapidly, and in accordance with the current standard for static line parachuting. Proper execution of the current exit standards supports safe operations.

Finally, commanders should examine the individual loads that soldiers are carrying and make sound risk management decisions on the benefits and hazards associated with airborne operations. ♦

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